REMARKS

The holding of allowable subject matter is gratefully acknowledged. Claims 6 and 9 have been put in independent form so that they can be allowed. Applicants respectfully submit that this does not narrow claims 6 and 9 and therefore does not result in any filewrapper estoppel statements with respect to the language of the material added from prior claims.

Claim 16 has been amended to correct the typographical error pointed to by the Examiner. Applicants respectfully submit that this change does not relate to the scope of the claim and therefore should not result in any filewrapper estoppel.

<u>Art rejections</u>

The art rejections are respectfully traversed.

Any of the Examiner's rejections and/or points of argument that are not addressed below would appear to be moot in view of the following. Nevertheless, Applicants reserve the right to respond to those rejections and arguments and to advance additional arguments at a later date. No arguments are waived and none of the Examiner's statements are conceded.

The prior comments are incorporated by reference and supplemented as follows:

One problem that appears is that the last amendment provided by Applicants included color drawings illustrating the contrasting operations of the invention and the primary reference. When these drawings were scanned in, the colors were lost. The orange became dark and the yellow disappeared entirely. The Examiner has stated that she does not understand the calculations. Applicants believe this may be because the scanning process caused important

REMARKS

information to be lost. Applicants submit herewith new drawings, not in color, and supplemental calculations in the hope that the Examiner will now understand.

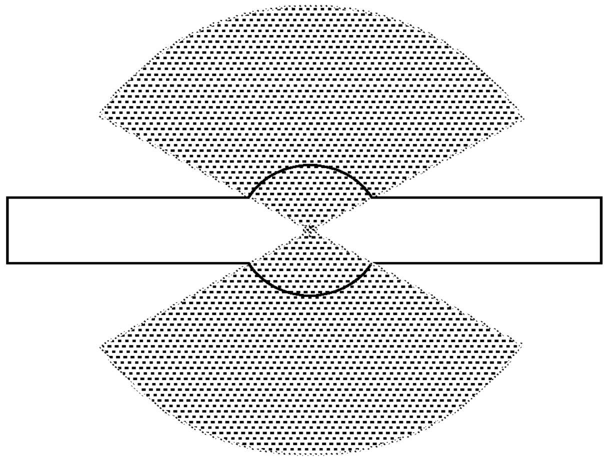
A difference of opinion amongst translators has arisen as to whether Sakugi discloses "blast" nozzles. Applicants respectfully submit that there is no particular reason to believe one translator over another and therefore that the interpretation of Applicants' translator should govern.

<u>To clarify the concept of the 'beam path' in reflector lamps:</u>

The "beam path" in a reflector lamp is created by all light rays that are emitted by the lamp that then travel towards the reflector, and that are then reflected by the reflector towards a certain direction (e.g. in a parallel beam-pattern for parabolic reflector or focused for an elliptic reflector). Thus, the "beam path" is not given alone by the beam-pattern in front of (outside) the reflector, but also by the light-rays inside the reflector. The following figures are offered to clarify what happens in regard to the "beam path" inside the reflector.

The following figure shows the emission pattern (dotted) of the bare burner:

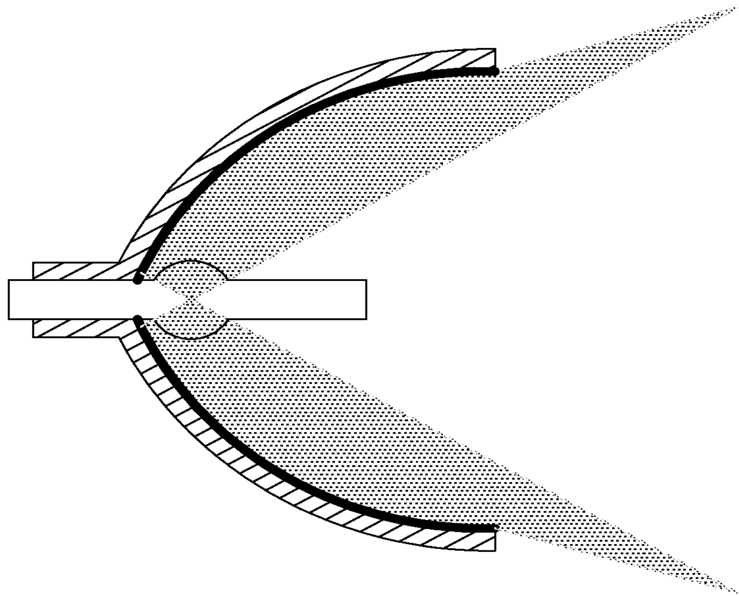
REMARKS



The pattern is rotationally symmetric around the long axis of the burner. The reason that no light is emitted into certain directions is that the light is blocked by the burner itself, namely by the electrodes and the quartz geometry (absorption and total internal reflection). This emission pattern of bare burners is well known and follows from fundamental physical and geometrical reasons.

The next figure shows the burner inside of a reflector:

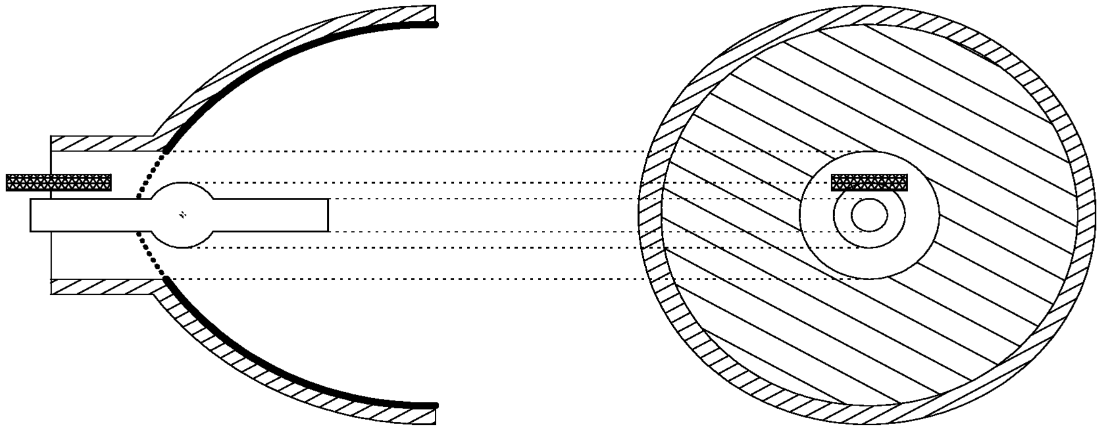
REMARKS



Again, the pattern (dotted) is rotationally symmetric around the long axis of the burner. The reflecting surface of the reflector is indicated by a thick black line. The figure shows which parts of the reflector are illuminated by the emission pattern of the bare burner. To simplify the figure, the reflections of the light from the bare burner are not shown. Clearly, almost all parts of the reflecting surface are illuminated by the burner (also the parts close to the neck of the reflector).

The next figure shows a reflector with a nozzle according to Sakugi:

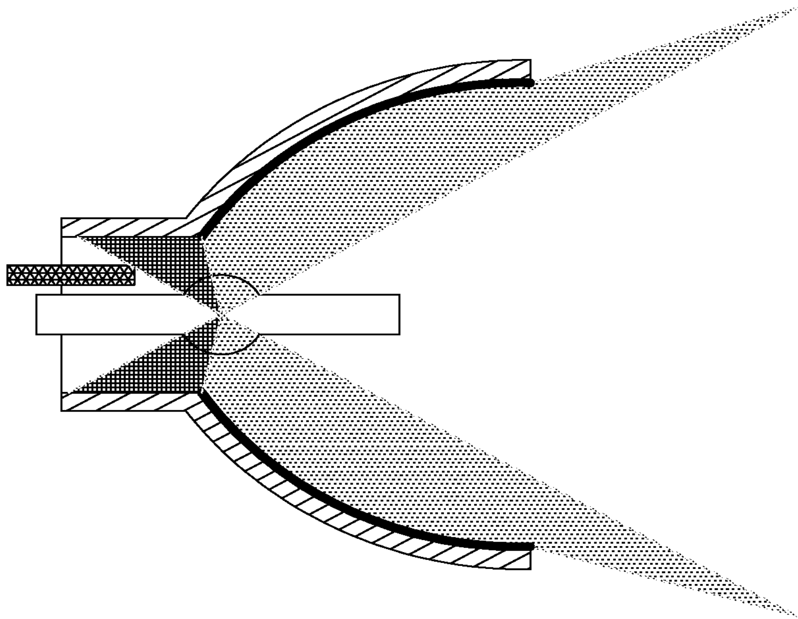
REMARKS



To make room for the nozzle (meshed rectangle in the reflector neck), a significant part of the reflector has to be removed. The missing reflecting surface is shown as dotted black line in the left part of the figure. The right part of the figure shows the size of the hole due to the nozzle, seen from the front of the reflector.

The next figure shows the emission pattern (dotted) using a Sakugi-reflector (with a large hole for the nozzle):

REMARKS



Again, the pattern is rotationally symmetric around the long axis of the burner. The region close to the reflector neck which is shaded in dark grey (plaid) shows the part of the light emitted from the bare reflector that is lost, since it does not illuminate the reflective surface of the reflector. A reflective coating of the horizontal part of the reflector neck would be of no use, since due to the law of reflection (angle of incidence = angle of reflection) the light cannot be reflected back towards the reflector front-side.

Clearly, the light loss due to the nozzle in the beam path is significant, even though the nozzle is *"in the back of the reflector"*

REMARKS

Regarding the calculation of the light loss (see e.g. claim 1, claim 10)

Formulas used:

area: $A = pi * (radius)^2$

solid angle: $\Omega = 2 * pi * (1 - \cos(angle))$

Sakugi does not disclose any dimensions of his lamp, but since we are only interested in relative effects ("how much of the reflective surface is lost?"), we can use an arbitrary scale. For comparison, we use a burner dimension of 10 mm (as for UHP).

From Sakugi's figure, we see that the diameter of the hole in the reflector neck is about one third of the diameter of the reflector. The nozzle in one of our preferred embodiments has a diameter of only 2% of the reflector diameter, located at about

$d = (15 \times \text{nozzle-diameter})$ above the burner.

With a fully reflecting surface, light between 90° and 30° (measured from the long burner-axis) can be collected in the backwards direction. In Sakugi's setup, due to the hole in the reflector neck, only light between 90° and about 77° can be used. Towards the reflector front-side, light can be collected between 90° and 39°. These numbers may vary slightly for different nozzle and reflector dimensions, but the fundamental result will stay the same.

With these formulas and numbers, we get for the ratio of the nozzle areas to the reflector cross-sectional area:

REMARKS

Sakugi: $(0.3)^2 / 1^2 = 0.09 = 9\%$

Present invention: $(0.02)^2 / 1^2 = 0.0004 = 0.04\%$

However, the area-ratio is misleading, since the reflecting surface does not have a constant distance to the burner. Close to the neck, the reflector is much closer to the burner than at the reflector's front-side. ***At smaller distances, a loss in reflecting area will have much more severe consequences than at longer distances***.

Therefore, we also calculated the solid angle of the usable light without and with the different nozzle designs (with 4 * pi for the total solid angle):

without nozzle: total solid angle minus (areas blocked by the burner itself or missing the reflector), with the angle-values given above:

$$4 * pi - 2 * pi * ((1\text{-}\cos(30)) + (1\text{-}\cos(39))) = 10.32$$

Sakugi: total solid angle minus (areas blocked by the burner itself, missing the reflector, or illuminating the nozzle-hole), with the angle-values given above:

$$4 * pi - 2 * pi * ((1\text{-}\cos(77)) + (1\text{-}\cos(39))) = 6.30$$

REMARKS

Present invention: solid angle of the nozzle itself (easier to calculate, since it is not located rotational symmetric, but straight above the burner), with the nozzle-size and –distance given above:

2* pi * (1-cos(arctan(0.5 / 15))) = 0.0035

Thus, the loss in solid angle due to the blocking of light by the nozzles is:

Sakugi: (10.32 – 6.30) / 10.32 = 0.39 = 39%

Present invention: 0.0035 / 10.32 = 0.00034 = 0.034%

Altogether, it can be said that by a nozzle-design as Sakugi has shown, the nozzle and the hole necessary to accommodate the nozzle together prevent a significant part (almost 40%) of the light-flux from being reflected, whereas in the present invention only a very small part of the light-flux is lost. Accordingly, despite the nozzle of Sakugi looking inconspicuous, in fact – together with the rotationally symmetric hole in the reflector that it necessitates – it extends substantially into the beam path. This is contrary to the recitations of claim 1. Applicants accordingly respectfully submit that the reference fails to teach or suggest claim 1.

New claim 17 has been added with slightly different wording. This claim recites that the nozzle and opening do not substantially reduce an amount of light in the beam path. Applicants

respectfully submit that this claim distinguishes even more clearly over the reference than claim 1.

Blast nozzle and turbulence: (e.g. claim 3)

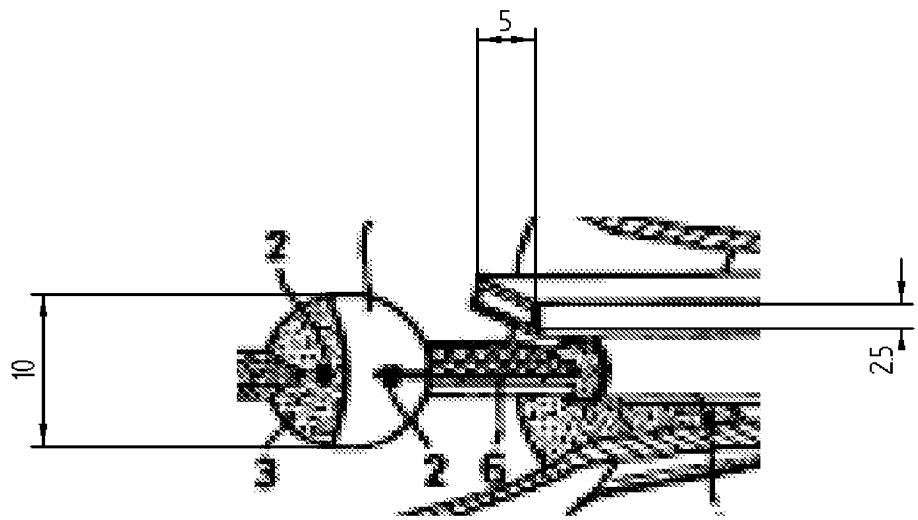
One of the inventors has now clarified to the undersigned that nozzles for cooling lamps are known to operate two different modes: continuous or pulsed ("blast"). Applicants respectfully submit that the Examiner has not made a *prima facie* case that the Sakugi lamp has a "blast" type operation. However, even if the reference did disclose "blast" type operation, Applicants respectfully submit that this would not teach or suggest the claimed invention.

The present patent application discusses a "flow of gas." Applicants respectfully submit that, since continuous operation is standard in the art of cooling discharge lamps, one of ordinary skill in the art would understand this terminology to imply continuous operation. One of ordinary skill in the art would not understand the disclosure or claims of the present application to disclose "blast" or pulsed operation. One of ordinary skill in the art would therefore understand the claims and disclosure to relate to an arrangement of the nozzles and a special operation mode of the cooling, in order to produce a turbulent flow, which is more efficient for cooling purposes, without blast operation.

If Sakugi's nozzle is operated as a blast nozzle, there is a very good chance that the explosive expansion of the cooling medium leads to a turbulent flow. However, this intermittent operation of the cooling flow is then different from the present invention, which describes a way to obtain turbulence even though the cooling flow is operated continuously (and not pulsed).

REMARKS

If, on the other hand, Sakugi's nozzle is operated continuously, then most probably no turbulence will develop. It is a well-known rule that for technical systems with Reynolds-numbers below 2300, the flow will be laminar. Sakugi states that in his experiment, the air flow was 1 ℓ/ min. The dimensions of the nozzle were estimated from the figure in Sakugi's patent, assuming that the bulb of the burner has a diameter of 10 mm:



With these numbers, the area of the nozzle is 12.5 mm^2, its diagonal is 5.6 mm. Thus the velocity of a continuous air flow of 1 l/min from this nozzle is 1.3 m/s.

The Reynolds-number for this situation is given by:

Re = velocity * diagonal / (kinematic viscosity)

REMARKS

The kinematic viscosity of air at room temperature is about $1.5 * 10^{-5}$ m^2/s (at higher temperature, the viscosity will increase, thus decreasing the Reynolds-number). Thus, the Reynolds-number for Sakugi's nozzle-design is:

$$Re = 1.3 * 5.6*10^{-3} / 1.5*10^{-5} = 485$$

This is clearly far below the critical Reynolds-number of 2300, so the flow will be laminar.

Altogether, Sakugi describes a situation different from the present application: either he is using the nozzle in a pulsed, intermittent manner (where it is no problem to create turbulence), or his flow is laminar. The present application describes a situation, where the flow is continuous, which means not turbulent *per se* as a pulsed flow would be. Applicants accordingly respectfully submit that the rejection is legally insufficient with respect to claim 3.

New claim 18 has been added to clarify that the flow of gas in the invention is not pulsed. Applicants respectfully submit that this is not new matter, because one of ordinary skill in the art would understand the language of the application to relate to non-pulsed operation.

Would one of ordinary skill in the art have looked to these references?

Applicants respectfully submit that it would not be obvious to combine Sakugi and Lapatovich to arrive at the claimed invention, as the Examiner does.

As set forth in the background of the invention section of the specification, the present invention arose from the necessity of creating non-uniform cooling, i.e. cooling a top portion of a discharge vessel more than a bottom portion.

REMARKS

Sakugi also relates to non-uniform cooling.

Lapatovich explicitly discloses a cooling arrangement that cools the discharge vessel in a *"uniform way, preventing hot-spot development"*. One of ordinary skill in the art would therefore not have looked to this patent to solve the problem of non-uniform cooling; and would not have combined it with Sakugi.

Moreover, the film that Sakugi uses for insulation, discussed above, is not mobile. As a result, with multiple nozzles, it would not function properly. This is a further reason why Sakugi cannot be combined with Lapatovich.

<u>Claims 4 & 11</u>

The Examiner has now conceded that Sakugi fails to teach or suggest that an angle between two nozzles might produce turbulence. The Examiner now cites Lapatovich for nozzles at an angle with respect to each other; however the Examiner has not indicated where Lapatovich teaches or suggests that such an angle might produce turbulence. The references are apparently accordingly similarly deficient with respect to the concept of an angle between two nozzles producing turbulent flow. The conclusion drawn by the Examiner in rejecting claim 4 over these references therefore must be based on impermissible hindsight in light of Applicants' disclosure; and is accordingly respectfully traversed.

Claim 11 similarly recites turbulent flow resulting from an angle between nozzles and is therefore analogous to claim 4 with respect to this argument.

REMARKS

Claim 5

The Examiner cites col. 4, lines 52-54 of Lapatovich as teaching nozzles that are at 90 degrees with respect to one another. Applicants have read the cited portion of Lapatovich and disagree as to its interpretation. Applicants understand the language to relate to the figures, in which the angles are not 90 degrees. The language merely states that the nozzles are at equal angles. This means, given that there are 3 nozzles and 360 degrees in a circle, that the nozzles are at an angle of 120 degrees with respect to one another. Applicants accordingly respectfully submit that this rejection is incorrect.

Claim 8: Controllability of nozzles:

This claim recites that the velocity of the flow of air can be controlled as a function of position of the lamp.

The Examiner purports to find this in paragraph 11 of Lapatovich. This paragraph discusses a lamp being positioned horizontally and then flow being turned on a particular velocity, namely 1 liter per minute[1]. However, there is no indication that this velocity is a function of position. It is just a position and a flow that were chosen to test the lamp. There is no teaching or suggestion that the position or flow were considered to be related to each other.

Moreover, Sakugi's film cannot be moved, so changing the flow as a function of position of the lamp would result in damage to the lamp. Therefore Sakugi cannot be used in this context.

---

[1] Note that the Examiner's translation says "litter," another error.

REMARKS

Nevertheless new claim 19 is added to clarify that control occurs automatically responsive to sensed position. Applicants respectfully submit that this claim distinguishes even more clearly over the references cited by the Examiner.

Claim 10

With respect to Clam 10, differing interpretations have arisen regarding what the ambiguous figures of Lapatovich really depict. Applicants respectfully submit that their interpretation is entirely consistent with the drawing and stems from one of the inventor's extensive knowledge of the lighting field. Moreover, the Examiner has failed to demonstrate that Applicants' interpretation is wrong or that her interpretation is better, which would be consistent with her burden of proof. Applicants accordingly respectfully submit that the Examiner's refusal to accept their interpretation is improper; and that the Examiner has contrived her interpretation of Lapatovich's drawing using impermissible hindsight in light of Applicants' disclosure.

Moreover, Sakugi emphasizes *"thermal insulating film on the surface of the upper part of the luminous tube's sealed part on the side in which the blast nozzle is located"* (claim 1). This insulating film appears to be the thrust of Sakugi's disclosure, as it prevents "stray cooling-air" from cooling the sealing of the discharge vessel and is featured in Sakugi's claim 1.

The present invention precludes the need for such an insulating film, since the claimed nozzle is located away from the neck of the reflector and does substantially interfere with the light-beam path. Accordingly, the claimed invention has a functional advantage not disclosed in the reference.

REMARKS

Claim 12

The Examiner states that Lapatovich shows nozzles perpendicular to the beam path. In fact, so far as Applicants can discern, Lapatovich fails to indicate what angle the nozzles might form with respect to the beam path. The projection of Fig. 3 does not reveal such information. Applicants accordingly respectfully submit that the Examiner mischaracterizes the reference.

Claim 14

This claim recites that a nozzle is arranged near the exit window and points back substantially toward the neck of the reflector.

The Examiner purports to find this in Fig. 3. Applicants respectfully disagree. Applicants see no basis for thinking that any of these nozzles is positioned near an exit window and no basis for determining what angle they may be situated at. Indeed, this interpretation by the Examiner seems to contradict her earlier interpretation, which stated that the picture shows the rear of the lamp and the nozzles poking into the reflector. If this interpretation were correct – which Applicants have previously argued was not the case – then all of the nozzles would be poking approximately into the mid portion between the neck and the exit window. None of them appear to be near the exit window, which would be at the edge of the reflector – i.e. at the outer circle – at all.

Applicants accordingly respectfully submit that the Examiner's statements rejecting claim 14 with respect to Lapatovich are incorrect.

REMARKS

New claims 21-24

New claims 21-24 have been added to emphasize the position dependence of the control of the flow according to the invention.

Such a measure is not possible in Sakugi's design, since the thermal insulating film shall be located at the upper portion of the sealing area. This insulating film is fixated on the burner surface and cannot be moved at run-time. Therefore, when the lamp's orientation changes, the position of the film cannot be controlled/changed. Thus, Sakugi's invention cannot simply be extended towards a position independent design.

Please charge any fees other than the issue fee to deposit account 14-1270. Please credit any overpayments to the same account.

REMARKS

Applicants respectfully submit that they have addressed each issue raised by the Examiner — except for any that were skipped as moot. Allowance is accordingly respectfully requested.

Respectfully submitted,

/A. Barschall/

By________________________________

Anne E. Barschall, Reg. No. 31,089
Tel. no. 914-332-1019
Fax no. 914-332-7719
Date of printing: August 7, 2007

In house contact at assignee:
Frank Keegan
Reg. No. 50,145
Tel. # 914-333-9669